

sPHENIX Simulations Meeting

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Goals of the study

Module to reconstruct the π^0

1. Find a local maximum tower
2. Group 3 x 3 cluster around it (also 5x5, 7x7)
3. Pair two clusters & look at the invariant mass peak
4. Show the invariant mass vs p_T , asymmetry between the two photons.
5. Pythia + π^0 embedded to look at invariant mass
 1. A module is needed to adjust the gain by expectation out of factory, then check π^0 peak again —> Quantify the gain variation we tolerate in 1 day.
 2. Obtain a global energy scale correction —> how good can we do a global energy scale calibration
 3. Tower by tower gain calibration —> how well we can calibrate the EMCAL
 1. do π^0 simulation
 2. calibrate the gain, check calibrated gain vs truth

References:

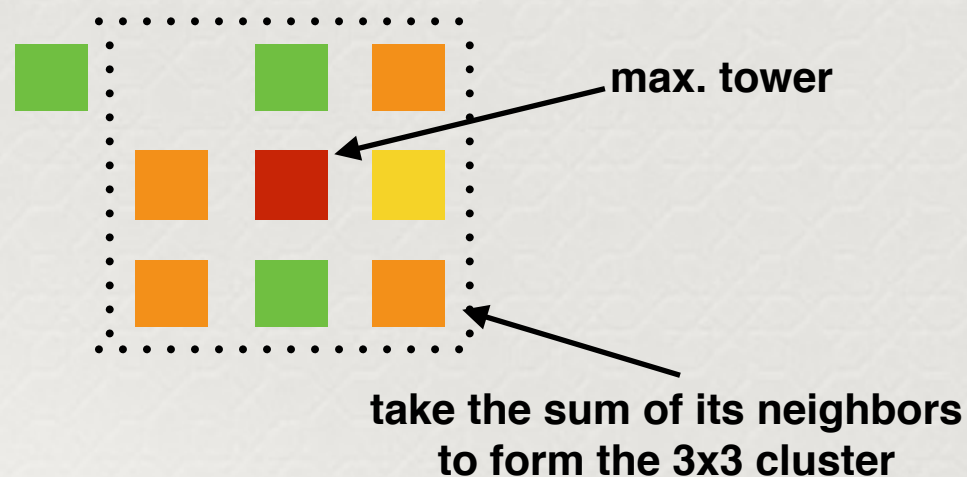
- Discussions with: Jin Huang, Craig Woody, David Gabor
- Jeff Mitchell @ sPHENIX software & simulation Workfest July 2015 "Experience on EMCal calibration @ PHENIX"

<https://indico.bnl.gov/conferenceOtherViews.py?view=standard&confId=1237>

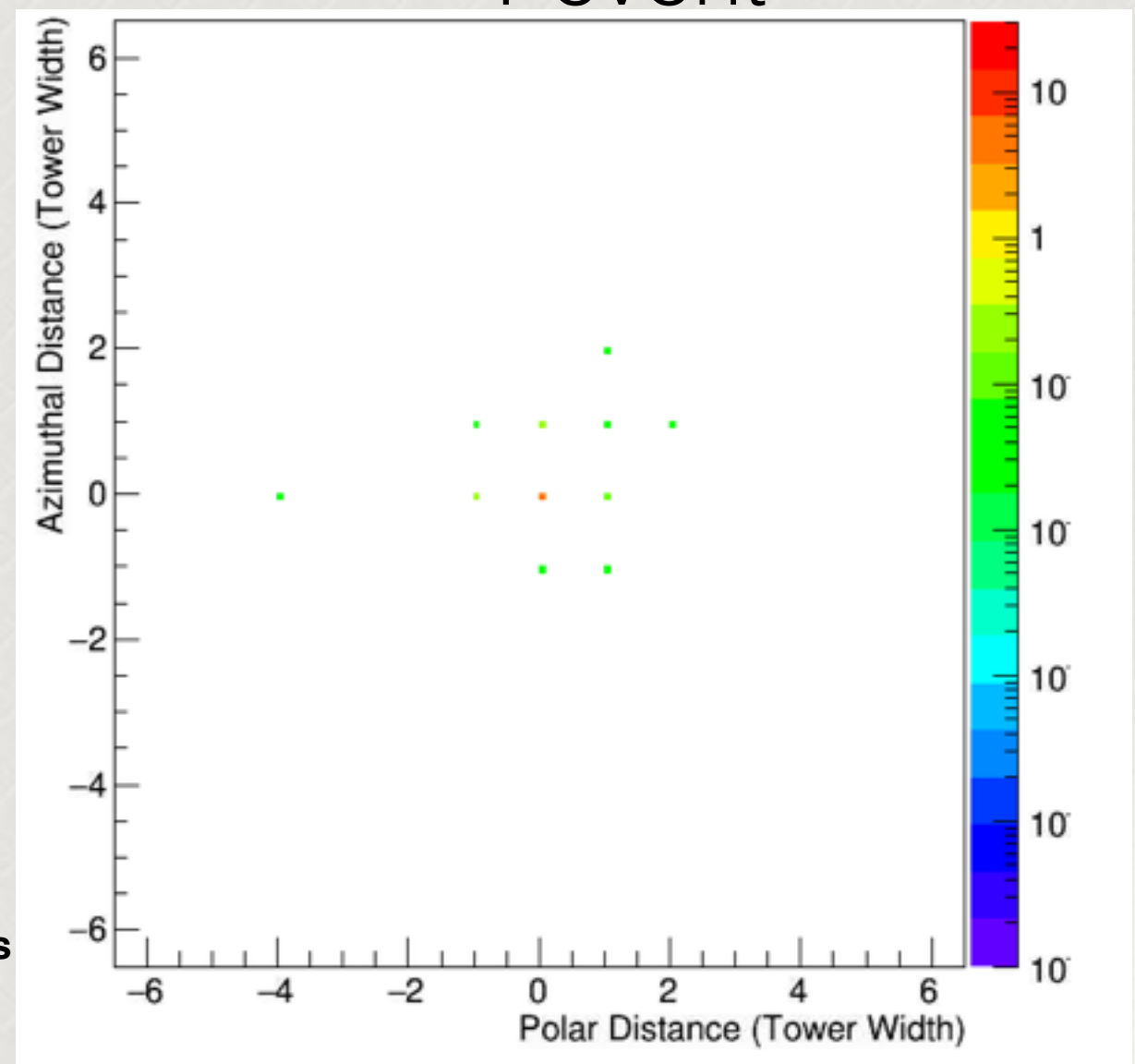
Clusterizer Overview

The 2D SPACAL was used in this study.

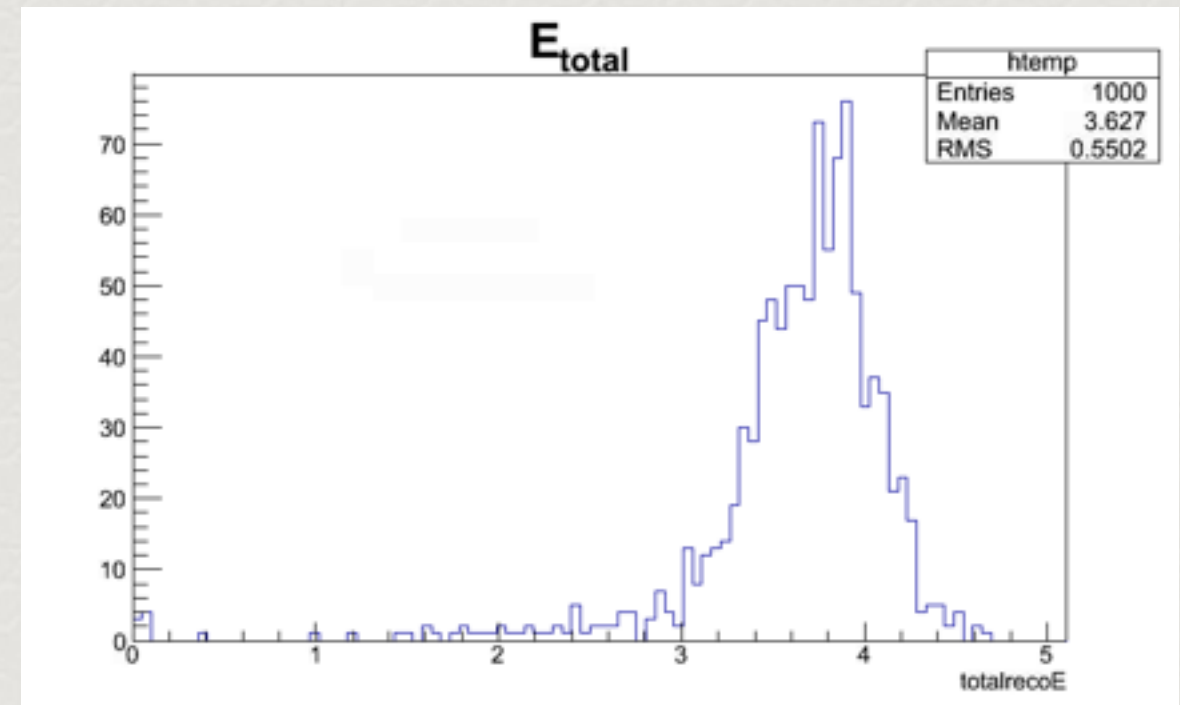
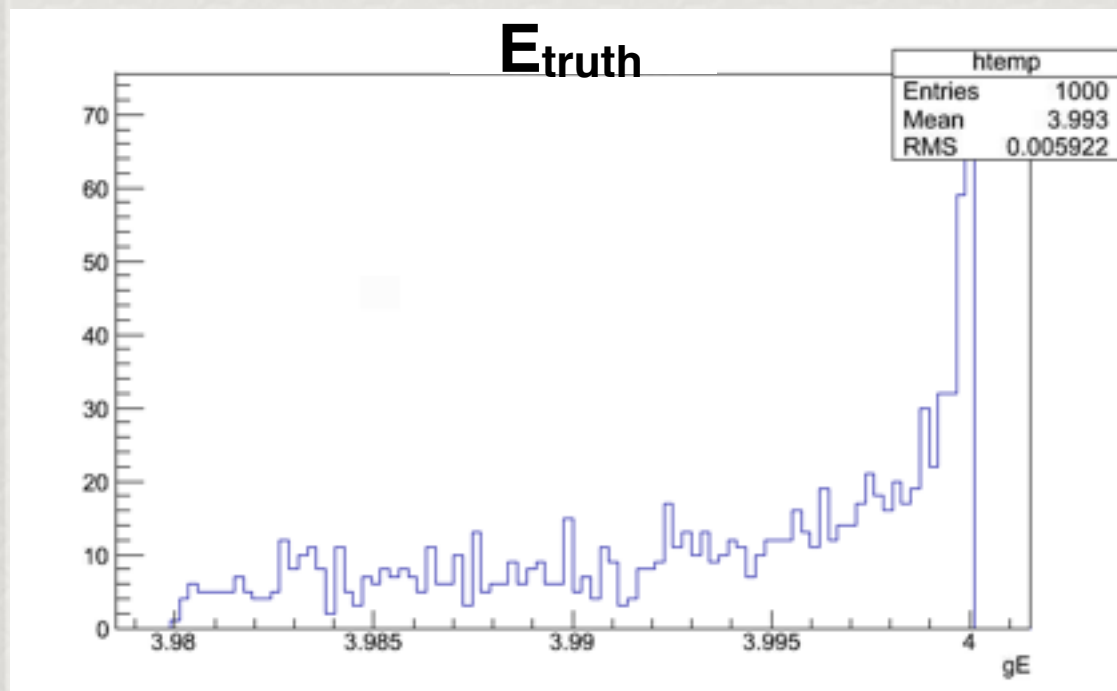
1. Find a local maximum tower for each event.
2. Group 3 x 3 cluster around it (also 5x5, 7x7)



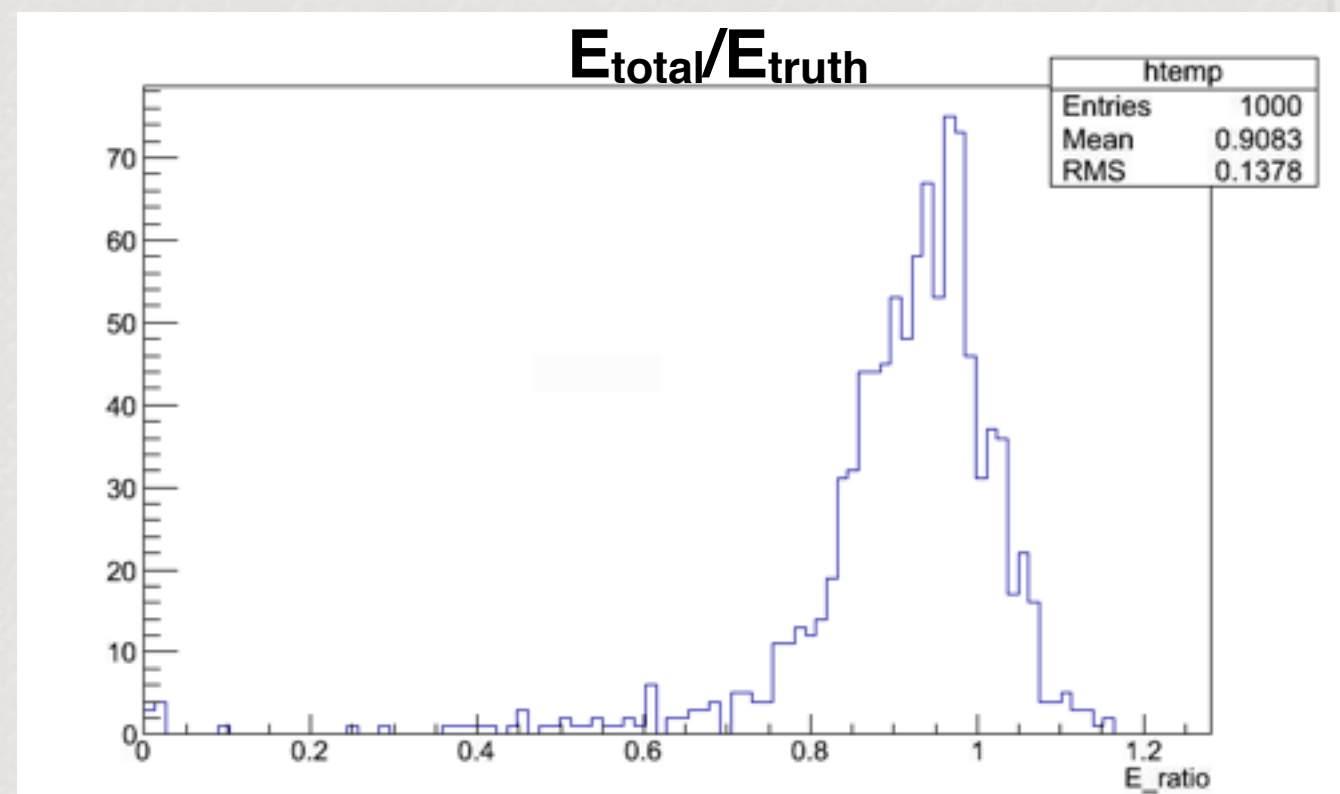
1 event



Energy Resolution

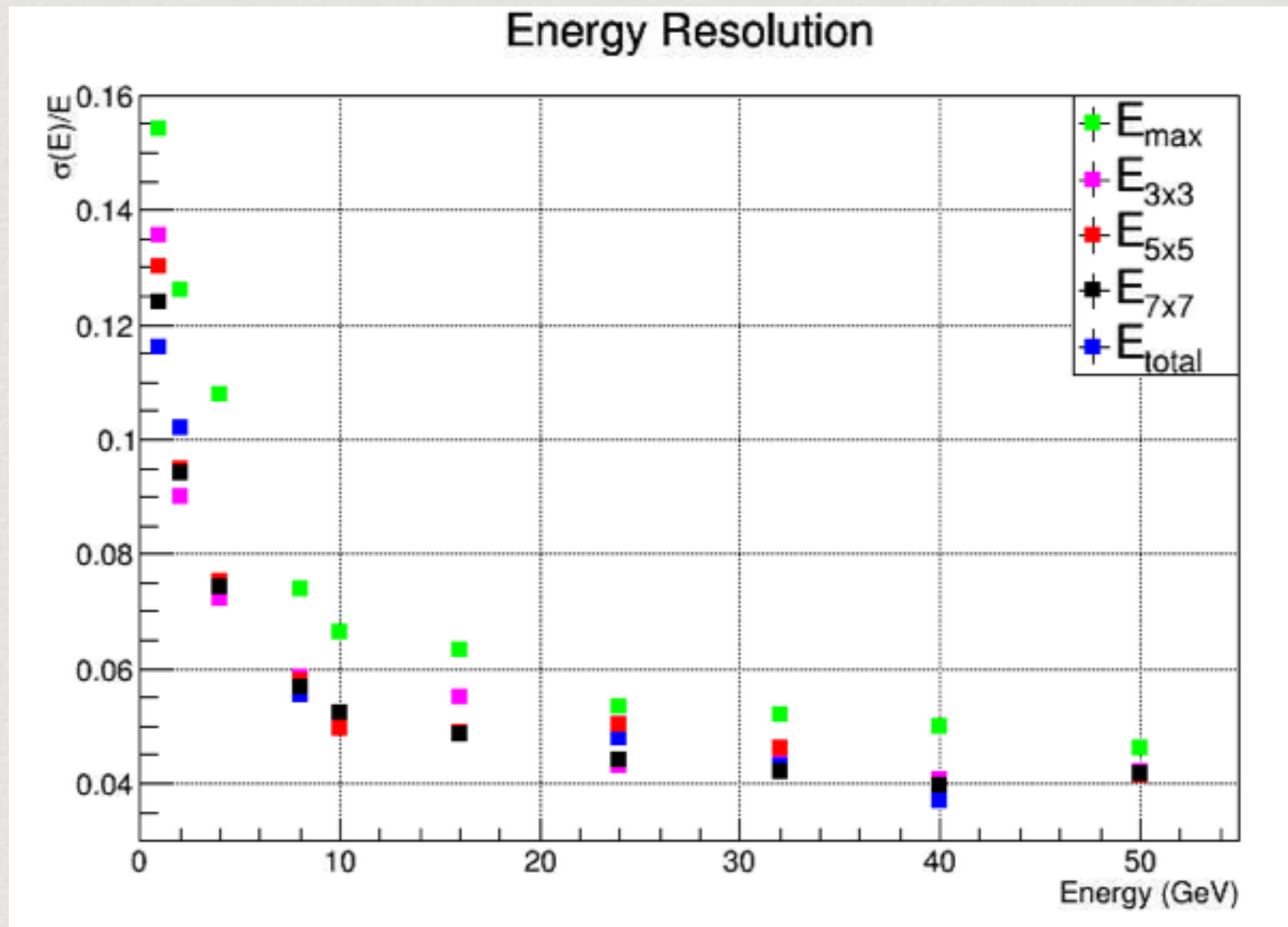


1. Find the maximum energy tower
2. Find the 3by3 cluster of its neighbors (same for 5x5 & 7x7)
3. Take the sigma from the gaussian fit of the total energy/reconstructed energy ($\sigma(E)/E$)



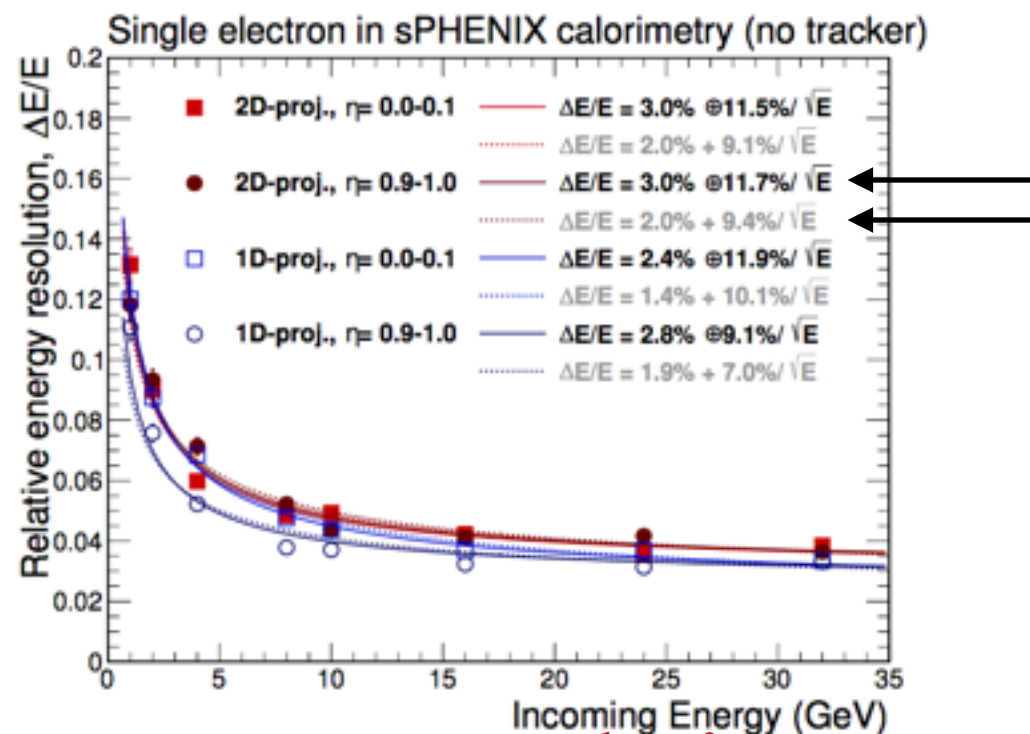
The 2D SPACAL was used in this study.

Energy Resolution

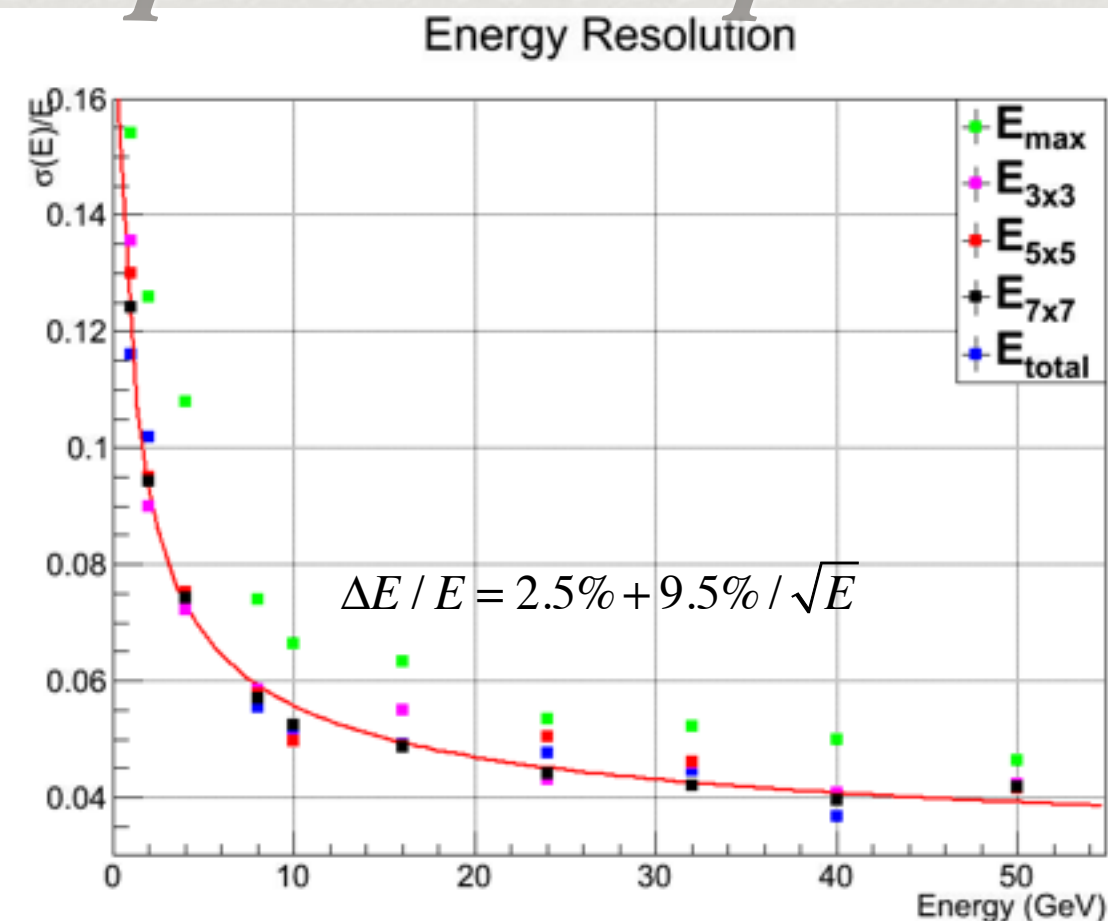


The 2D SPACAL was used in this study.

Energy Resolution compared to the pCDR



**Energy Resolution
from the pCDR**



Fit values (total energy) obtained: $\Delta E / E = 2.5\% + 9.5\% / \sqrt{E}$

**Most similar to 2D proj.
(eta range 0.9-1):**

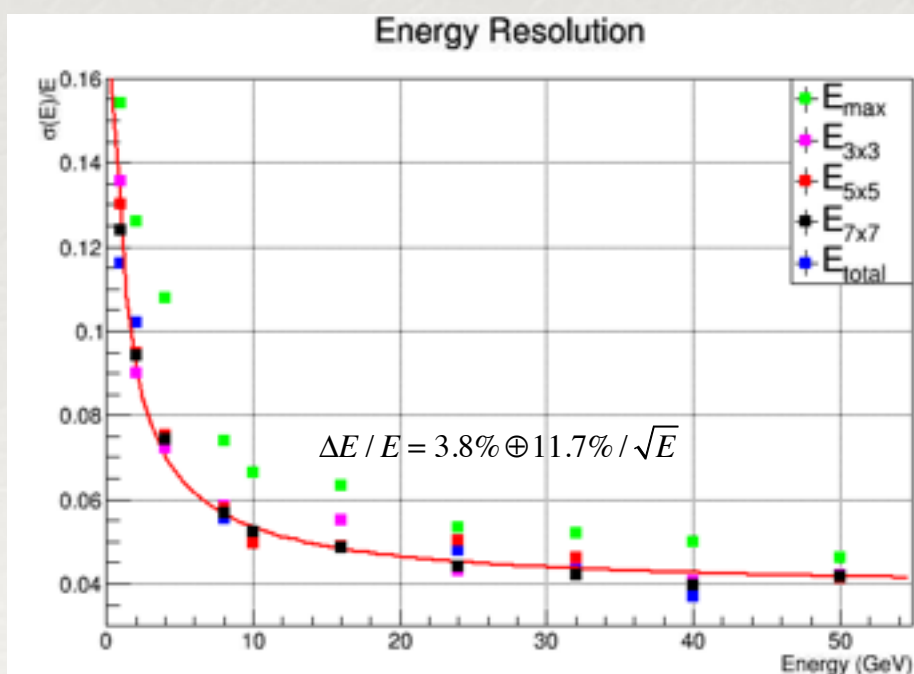
$$\Delta E / E = 2.0\% + 9.4\% / \sqrt{E}$$

convoluted Fit values (total energy) obtained:

$$\Delta E / E = 3.8\% \oplus 11.7\% / \sqrt{E}$$

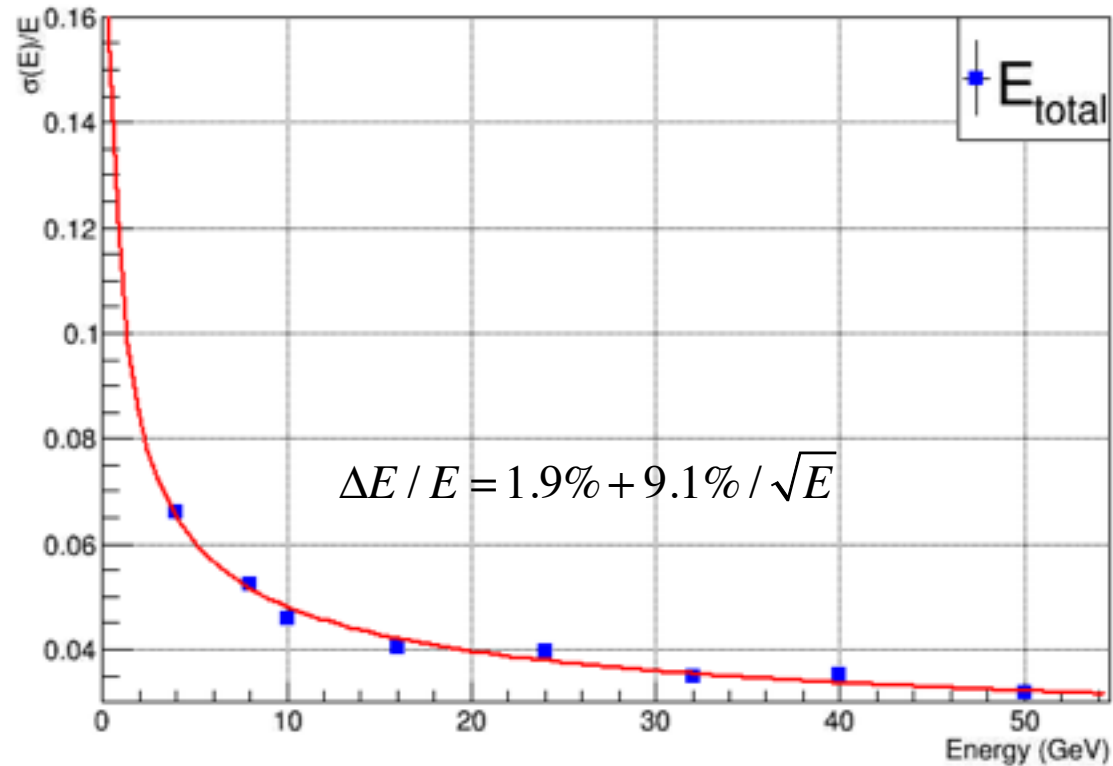
**Most similar to 2D proj.
(eta range 0.9-1):**

$$\Delta E / E = 3.0\% \oplus 11.7\% / \sqrt{E}$$

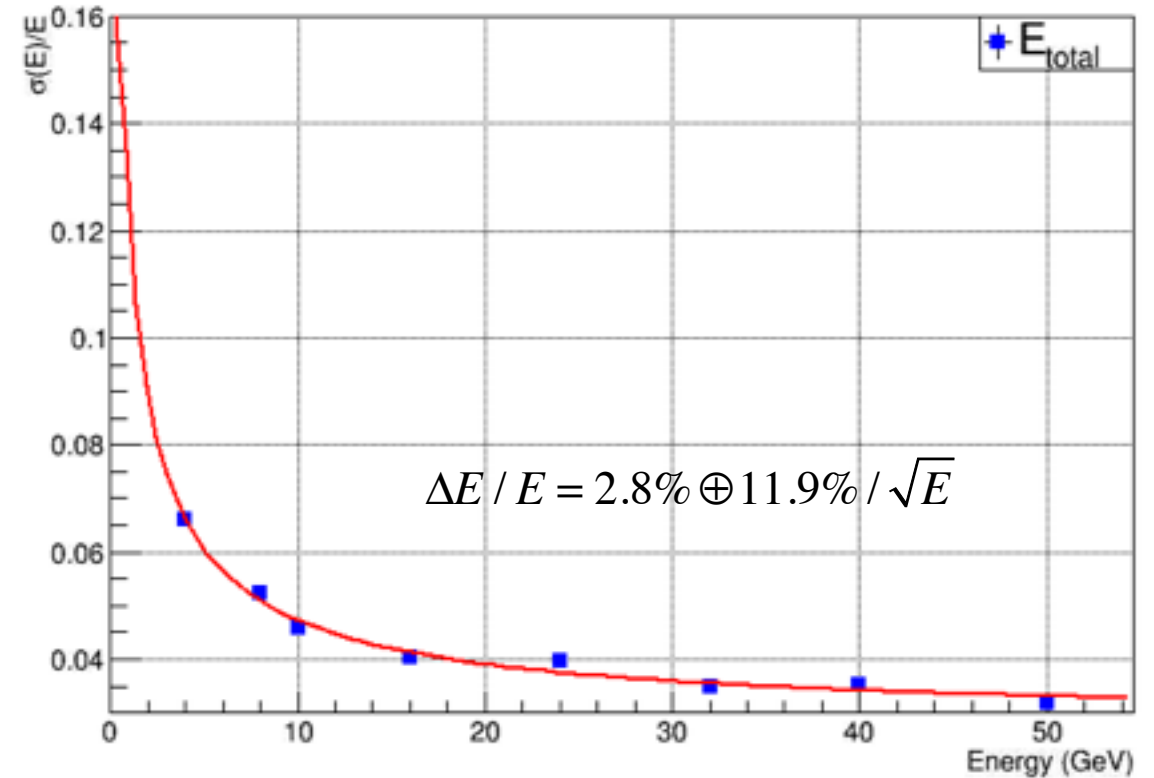


Energy Resolution compared to the pCDR

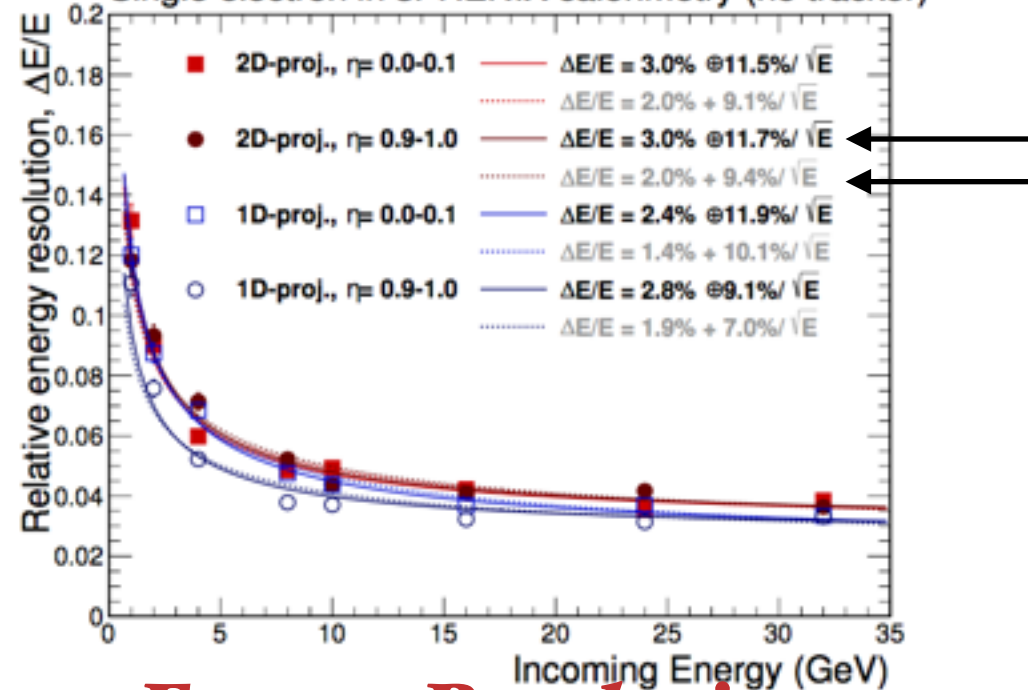
Energy Resolution (electrons)



Energy Resolution (electrons)



Single electron in sPHENIX calorimetry (no tracker)



Fit values (total energy) obtained: $\Delta E / E = 1.9\% + 9.1\% / \sqrt{E}$

Most similar to 2D proj. (eta range 0.9-1): $\Delta E / E = 2.0\% + 9.4\% / \sqrt{E}$

convoluted Fit values (total energy) obtained:

$$\Delta E / E = 2.8\% \oplus 11.9\% / \sqrt{E}$$

Most similar to 2D proj. (eta range 0.9-1): $\Delta E / E = 3.0\% \oplus 11.7\% / \sqrt{E}$

**Energy Resolution
from the pCDR**

Summary / To Do List

Completed:

- *Clusterize 3x3, 5x5, 7x7 tower energy per event for photons*
- *obtain the energy resolution and compare to pCDR*
- *(repeat for electrons)*

To Do List:

- *Find the second tower per event to pair two clusters and find the invariant mass peak*